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# AFRICA

## Improving Child Nutrition for Sustainable Poverty Reduction in Africa

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**W**hile famines and other episodes of severe hunger receive significant press coverage and attract much public attention, chronic hunger and malnutrition are considerably more prevalent in Africa. It is estimated that 14 percent of children are born with low birthweights every year, around 45 million preschool children are malnourished, and 192 million Africans of all ages are hungry. Despite these levels of malnutrition, improvements in child nutrition receive short shrift in many African poverty reduction strategy papers.



**T**his likely reflects both an overestimation of the rate by which economic growth will improve nutritional status—even if economic growth accelerates in Africa, relying solely on growth will mean that it will take generations to eliminate malnutrition—and an underestimation of the beneficial effects of improved nutrition on economic growth.

**This brief argues that failing to give adequate attention to child nutrition issues is shortsighted if African governments seek sustainable reductions in poverty. In poorly nourished populations, reductions in hunger and improvements in nutrition provide considerable productivity gains and save resources that can then be used for other pressing investments. It is the existence of these sizeable gains together with the availability of cost-effective interventions that underlies the economic case for improving child nutrition in Africa.**

## THE CAUSES AND CONSEQUENCES OF CHILD MALNUTRITION IN AFRICA

In Africa, as in other parts of the developing world, poor nutritional outcomes begin in utero. A number of maternal factors have been shown to be significant determinants of intrauterine growth retardation (IUGR), the characterization of newborns who do not attain their growth potential. Most important are the mother's height (reflecting her own nutritional status during childhood), her nutritional status prior to conception (as measured by her weight and micronutrient status), and her weight gain during pregnancy. Diarrheal disease, intestinal parasites, and respiratory infections may also lead to IUGR, and, where endemic, malaria is a major determinant as well.

A second vulnerable period is the first two years or so of life. Young children have high nutritional requirements, in part because they are growing so fast. Unfortunately, the diets commonly offered to young children in African countries to complement breast milk are of low quality—lacking variety and with low energy and nutrient density—and, as a result, multiple nutrient deficiencies are common. Young children are also very susceptible to infections because their immune systems fail to protect them adequately. Foods and liquids are often contaminated with bacteria and are thus key sources of infections. Infections both reduce appetite and increase metabolic demands. Furthermore, traditional African remedies for childhood infections, including withholding

of foods and breast milk, are often suboptimal. Thus, infection and malnutrition reinforce each other.

A growing body of evidence indicates that growth lost in the early years is, at best, only partially regained during childhood and adolescence, particularly when children remain in poor environments. In Senegal, height at age three is strongly correlated with attained body size at adulthood. In Zimbabwe, children who were aged 12 to 24 months in the aftermath of the 1982–84 and 1994–95 droughts were, when assessed 6 to 18 years later, shorter than comparable peers not affected by these shocks. But the effects of malnutrition go beyond physical stature. Malnutrition, particularly severe malnutrition in early childhood, often leads to deficits in cognitive development. Malnourished children are found to score poorly on tests of cognitive function and have poorer psychomotor development and poorer fine motor skills. They tend to have lower activity levels, interact less with their environments, and fail to acquire skills at normal rates. Further, there is a growing body of evidence suggesting that undernutrition, particularly fetal undernutrition during critical periods, may result in permanent changes in body structure and metabolism that may lead to increased susceptibility to chronic noninfectious diseases later in life. Lastly, malnutrition may have long-term consequences due to the intergenerational transmission of poor nutrition and anthropometric status.

An additional contributing factor is micronutrient deficiency, particularly deficiencies in iodine, iron, and vitamin A. Approximately 42 percent of Africans of all ages are iodine deficient. Iodine deficiencies in utero and in the early years of life contribute significantly to increased risk of infant mortality and irreversible impair-

ment of mental capacities. Vitamin A deficiencies contribute to increased infant and child mortality as well as increased prevalence of blindness. About 33 million African preschoolers—that is, one in three children—are deficient in vitamin A. Iron deficiencies lead to low birthweights as well as markedly affecting cognitive development. As with iodine deficiencies, the damage appears to be largely irreversible.

Poorly nourished children tend to start school later, progress through school less rapidly, demonstrate poorer academic achievement, and perform less well on cognitive achievement tests when older, including into adulthood. There are at least three broad pathways influencing these outcomes. First, malnourished children often receive less education. This may be because their caregivers seek to invest less in their education, because schools use physical size as a rough indicator of school readiness, or because malnourished children may have higher rates of morbidity and thus greater rates of absenteeism from school. While remaining in school until a later age can compensate for delayed entry into school, this means that individuals enter the workforce later than they would have done otherwise and this carries opportunity costs in terms of forgone earnings. The second pathway from malnutrition to educational outcomes is via the capacity to learn, a direct consequence of the impact of poor nutrition on cognitive development, as described above. Lastly, a hungry child may be less likely to pay attention in school and may thus learn less even if he or she has no long-term impairment of intellectual ability. These three pathways clearly interact; a child with reduced ability to learn will likely spend less time in school and learn less while in class.

## FEASIBLE AND COST-EFFECTIVE INTERVENTIONS TO REDUCE CHILD MALNUTRITION IN AFRICA

While the discussion of the causes and consequences of child malnutrition highlights the intrinsic value of improving nutritional status in Africa, it does not—by itself—make an economic case for investing in children’s nutrition. This section outlines a series of feasible and cost-effective interventions that can reduce child malnutrition in Africa.

### ***Mechanisms for Reducing the Incidence of Low Birthweight***

Increasing birthweights requires improving the health of mothers. Interventions that can do so include antimicrobial treatments, antiparasitic treatments, insecticide-treated bed nets, provision of iron/folate supplements, targeted food supplements, and social marketing regarding birth spacing or timing of marriage.

A number of these interventions have been successfully implemented in Africa and elsewhere. For example, in Uganda, an intervention that treated more than 2,000 women for presumptive sexually transmitted disease was associated with a 2 percent reduction in the number of low birthweight (LBW) infants. As the therapy was reported to have cost US\$2 per treatment, this resulted in an estimated cost of US\$100 per LBW averted. A much smaller intervention in Kenya, targeted at pregnant women with a poor obstetric history, reduced the incidence of LBW by 14 percent. The marginal cost of this intervention is US\$14 per LBW averted. Another study in Kenya found that using treated bed nets to combat malaria was estimated to reduce the incidence of LBW by 28 percent. In a Gambian study, the provision of nutritional supplements to pregnant women reduced the prevalence of LBW by 6 percentage points. In an extensive field trial in a community in Nepal characterized by high rates of both LBW and maternal anemia, providing supplements of iron and folate was found to reduce LBW significantly. It is estimated that the costs of doing so on an ongoing basis are on the order of US\$13 to US\$14 per pregnant woman.

### ***Mechanisms for Improving Infant and Child Nutrition***

Adequate infant and child nutrition is the outcome of appropriate food and health inputs mediated through positive child-care practices. Several implications follow from this observation. First, a number of other interventions that go beyond the narrow confines of nutrition are important in the reduction of malnutrition in infant and preschool children. Improved water and sanitation and improved maternal education levels are examples. Second, dietary quality—particularly access to micronutrients—is important for children in this age group; this issue is addressed in the next section. Third, increasing dietary quality and quantity can be achieved, in part, by investments in agricultural research that improves the micronutrient value of crops. Fourth, some of the most promising interventions related to infant and child nutrition do not aim to increase the amount of food available



or the amount consumed, but rather to change how it is provided to the infant. We focus on two examples here.

Breastfeeding promotion and improved knowledge of the use of complementary foods are examples of this opportunity. In addition to reducing infant mortality, these interventions, where successfully implemented, are effective in reducing morbidity—particularly diarrheal morbidity. Thus, they reduce stunting and the consequent loss of productivity. Even with relatively high discount rates—on the order of 5 percent—reasonable estimates suggest that every dollar spent on breastfeeding promotion and improved knowledge of weaning foods produces present discounted value benefits of about four dollars, a cost-benefit ratio of 1 to 4.

These interventions can be complemented by community nutrition programs that improve child care practices and provide simple diagnostics that identify causes of inadequate child growth. The successful Integrated Child Care program in Honduras uses these approaches; evidence suggests that the program has led to reductions of more than 50 percent in moderate and severe malnu-

trition in a country where malnutrition rates are on the order of 40 percent. While the cost of preventing a child from being malnourished is estimated at US\$20, the present discounted rate of gains in productivity arising from reduced stunting and increased cognitive ability would, even using a 5 percent discount rate, be on the order of US\$320 for a typical African country, implying a cost-benefit ratio of 1 to 16. Similar programs have been successfully implemented in Senegal and Madagascar, although they have not yet been evaluated as thoroughly as the Honduran example.

### ***Mechanisms for Reducing Iodine, Vitamin A, and Iron Deficiencies***

The addition of potassium iodine or iodate to table salt is a widespread practice in both developed and developing countries and has been estimated to add no more than 5 percent to the retail cost of salt—two to seven cents per kilogram. The effects of successful interventions to prevent iodine deficiency can be rapid and striking. Madagascar went from no iodated salt in 1992 to 98.3 percent coverage by 1999, with a corresponding elimination of low urinary iodine in school children.

Field trials of mass supplementation of vitamin A to children 6 to 59 months of age indicated an overall reduction in child mortality of 25 to 35 percent. While the evidence on vitamin A interventions and growth is mixed (supplementation has little effect on the growth of moderately deficient children), children who are severely malnourished or who also have serious infections may benefit from supplementation. In various parts of Africa, vitamin A supplementation has been included in national polio immunization days. It has been estimated that the average cost of reaching a child through these immunization days is about US\$1, and that the inclusion of vitamin A in such campaigns adds 2 to 10 percent to the cost. However, polio campaigns do not provide frequent contact (only twice yearly), and in many countries these programs have been concluded. Consequently, a more sustainable approach may be to incorporate vitamin A supplementation into routine immunization schedules. As inoculation coverage generally declines with age, targeting vitamin deficiencies during these procedures offers a particularly effective window of opportunity to reach at-risk populations. Uganda's child health days cost US\$1 to US\$1.33 per child reached, with services including inoculations, growth monitoring, and vitamin A supplementation. The costs are set against the present discounted value of benefits associated with reduced mortality and productivity loss associated with blindness; these benefits



are on the order of US\$37 to US\$44, depending on the discount rate used.

Addressing iron deficiencies, particularly in Africa, is challenging because iron, unlike vitamin A, cannot be provided in megadoses. However, there are other vehicles for the delivery of iron. These include home-based fortification with sachets to be sprinkled on food, as well as industrial fortification of flour, rice, and salt; strategies to increase the frequency of consumption of animal-based foods; and changes in food preparation. An example of the latter is the provision of iron cooking pots in Ethiopia. This pilot trial found that the provision of pots (at a cost of about US\$3 per pot) was less expensive than providing supplements to the same population for a year. In addition to supplementation and fortification, the mass provision of deworming medicine may affect anemia. Research in Kenya has found that it cost US\$3.50 to increase school participation one child year via deworming; part of this increase was presumably due to reduced anemia. Similarly, a combined program of deworming and supplementation was found to increase preschool participation in New Delhi, India. Using a range of plausible assumptions, these results were extrapolated to estimate the impact on earnings; an additional US\$29 in net present value lifetime earnings was expected, at a cost of US\$1.70 per child. A similar intervention—a combination of deworming and daily iron supplementation—was found to improve motor and language development of preschool children in Zanzibar.

### ***The Role of Complementary Investments***

While the interventions described here represent promising approaches, complementary investments, activities, and opportunities also have important implications for reducing malnutrition. These investments include the following.

*Improving women's education and status.* Numerous studies show strong correlations between maternal education and reductions in undernutrition among preschool children. While these correlations are subject to some caveats, increasing women's education levels is likely to produce benefits in terms of reduced malnutrition.

*Addressing infectious diseases such as the HIV/AIDS pandemic.* HIV/AIDS increases hunger and malnutrition directly by reducing the income and food security of affected households and by interfering with the intergenerational transmittal of agricultural skills. In addition, young orphans and children with chronically ill caregivers risk higher rates of malnutrition. HIV also imposes a dilemma in assessing the increased risks of breast-

feeding versus the risks of not breastfeeding. Nutrition also affects HIV/AIDS, since nutritional status is a major factor influencing a person's risk of infection and effectiveness of care.

*Improving infrastructure.* Improvements in water quality and sanitation lead to reductions in diarrhea. Repeated diarrheal infections are correlated with faltering growth, particularly among children less than three years of age. Communication and transportation infrastructure investments can also help by serving to reduce the localized price shocks that may be an important factor in famines. These investments may lead to increased growth and therefore reduced chronic undernutrition.

## **CONCLUSIONS** FROM IMPROVED CHILD NUTRITION TO SUSTAINABLE POVERTY REDUCTION

These feasible and cost-effective interventions have the potential to play an important role in sustainable poverty reduction because the *economic* gains of reducing child malnutrition—in terms of both productivity and opportunity costs—are likely to be substantial. These gains operate through six channels:

1. reduced resource losses that arise from higher mortality;
2. reduced resource losses that arise from higher morbidity, both in terms of the cost of health care services and lost employment or schooling for caregivers;
3. productivity gains arising from the direct link between physical stature and physical productivity;
4. productivity gains arising from the links between preschool nutritional status, cognitive development, and schooling attained;
5. reduced resource costs that arise from an increased incidence of chronic disease later in life; and
6. intergenerational benefits.

The table illustrates the magnitude of the gains to be had from improving one dimension of child malnutrition, a reduction in the incidence of low birthweight.

The magnitude of these gains is large: on the order of two to eight times the per capita income of a typical African country. Note that the largest single source of gain arises from productivity increases associated with

**Table I—Present Discounted Value (PDV) of Economic Benefits Associated with Reducing Prevalence of Low Birthweight**

Pathway	PDV per low birthweight averted (US dollar value)
Reduced infant mortality	94.66
Reduced neonatal care and reduced costs of infant/child illness	80.63
Productivity gain from reduced stunting	180.17
Productivity gain from improved cognitive function	434.06
Reduction in costs of chronic diseases	73.83
Intergenerational benefits	122.26
Sum of PDV of six benefits	985.61

Source: Adapted, using a 3 percent discount rate, from Table 3 in H. Alderman and J. R. Behrman, "Estimated Economic Benefits of Reducing LBW in Low-Income Countries" (University of Pennsylvania, Philadelphia, 2003, Draft).

improved cognitive function, which, in turn, is tied to increased participation in schooling. If technological changes or other developments increase children's participation in schooling in Africa, these productivity gains will rise even further. Given the cost data provided above, benefit-cost-ratios of investments to reduce the prevalence of low birthweight—and other dimensions of poor child nutrition—are likely to indicate that such investments have high internal rates of return.

Finally, the people who are likely to benefit from these interventions tend to be relatively poor. Thus, the interventions—in addition to their intrinsic value in reducing child malnutrition—are likely to provide important gains in terms of reducing current poverty and increasing future productivity.

**For further reading: UN System Standing Committee on Nutrition, *Fifth Report on the World Nutrition Situation* (Geneva: SCN, 2004); John Strauss and Duncan Thomas, "Human Resources: Empirical Modeling of Household and Family Decisions," in *Handbook of Development Economics*, ed. J. Behrman and T. N. Srinivasan (Amsterdam: Elsevier, 1995); H. Alderman and J. Behrman, "Estimated Economic Benefits of Reducing LBW in Low-Income Countries" (University of Pennsylvania, Philadelphia, 2003, draft); J. Behrman, H. Alderman, and J. Hoddinott, "Hunger and Malnutrition" (International Food Policy Research Institute, Washington, D.C., 2004, draft); L. Haddad, H. Alderman, S. Appleton, L. Song, and Y. Yohannes, "Reducing Child Malnutrition: How Far Does Income Growth Take Us?" *World Bank Economic Review* 17 (No. 1, 2003): 107–131.**

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